TRANSPORTATION SAFETY REGULATORY BULLETIN

Written by Dana M. Willaford, DOE/OR, SE-32, willaforddm@oro.doe.gov, 423-576-5338

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NOTE FROM THE EDITOR

It has been a while since the last publication of the Bulletin, and based upon some of the phone calls received lately, it is time to start publishing again. I will try to issue these approximately once a quarter, and each one will concentrate on a timely special topic. This issue's topic is fissile material packaging. If you have an area of the regulations that you would like to see addressed, let me know and I will give it due consideration.

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FISSILE MATERIAL PACKAGING

There has been a considerable amount of interest and confusion recently about the fissile material packaging section of the regulations, so it is worthwhile to spend some time discussing this topic. Identifying and choosing fissile material packaging is a relatively straight forward process, but there are multiple regulatory sections that must be addressed to complete this process. Hopefully, the following explanation will make this less painful for the uninitiated shipper.

Where are the regulations that address fissile material packaging?

As with all radioactive material shipment, the starting point for determining the packaging requirements is column 8 in the Hazardous Material Table of 49 CFR. Finding the proper shipping name, "Radioactive material, fissile, n.o.s.", and following across the table to column 8A, we are referred to 173.453 for packaging exceptions and in column 8B we are referred to 173.417.

173.453 is for fissile material exceptions; what am I excepted from?

Contrary to what may be implied in the title of this section, if your material meets the requirements of this section, it is not excepted from the inherent property of being fissile, but is excepted from the packaging and controls that are required for fissile materials. This is reasonable, as what differentiates fissile material from other radioactive materials is the fact that

it can, under certain conditions, become "critical" and release heat and radiation. This is not desirable while transporting the material, so shipments of fissile materials have controls on them (mass configuration, accumulation, etc) to prevent criticality events from occurring.

The 173.453 section establishes mass or concentration limits that below which, any number of packages with this material could be transported together without the possibility of a criticality occurring. Therefore, no other controls (found in 173.457 and 173.459) are needed. Note that paragraphs (a)-(f) of this section are independent; only one paragraph needs to be met to take the fissile exception.

Fissile excepted material can be treated the same as any other radioactive material. The full range of packaging that is available for other radioactive materials is available for fissile excepted material. Fissile excepted material might meet the limited quantity or LSA/SCO definitions and therefore be shipped under these proper shipping names in excepted packaging. Alternatively, the "Radioactive material, n.o.s" proper shipping name with appropriate Type A or Type B packaging could be used.

My material isn't fissile excepted and I'm at the 173.417 section; now what do I do?

173.417 is a rather long section, but is logically laid out with all Type A packaging being listed under paragraph (a) and all Type B packaging in paragraph (b). These are your choices:

Type A fissile packaging
DOT Spec 6L
DOT Spec 6M
Type A pkg in 173.415 (including DOT 7A)
NRC/DOE approved Type A or B pkg
IAEA approved pkg (restricted use)
DOT Spec 7A in 1A2 55-gal. drum
DOT 7A cylinders for UF6 "heels"
DOT 20PF-1, 2,3; DOT 21PF-1A,1B (for UF6)

Type B fissile packaging
DOT Spec 6L
DOT Spec 6M
NRC/DOE approved Type B pkg
IAEA approved pkg (restricted use)
DOT 20PF-1, 2,3; DOT 21PF-1A,1B (for UF6)

At this point, it is a matter of evaluating your material against the authorized contents for the particular packaging. This will necessarily involve using the paragraphs and tables in 49 CFR or relevant sections in a Certificate of Compliance (CoC). In the case of using a DOT 7A under 173.417(a)(3), you must use 10 CFR 71, Subpart C. Some specifics with some of the more popular choices of fissile packaging are discussed below.

DOT Specification 6M

This package has been a mainstay with DOE for decades. It is authorized for both Type A and Type B quantities, with the restrictions being detailed in 173.417(b)(2), and the specifications in 178.354. This package requires use of a Specification 2R inner containment vessel, which is detailed in 178.360. The 2R is restricted to in maximum inner diameter on 5.25 inches for U-235 and Pu (178.354-3), and is restricted to 4.75 inches for U-233 [173.417(b)(ii)]. ***[There are additional restrictions with the use of a 6M for some shipments of Pu. See DOE O 460.1, 4.(4)(c), and 10 CFR 71.63]***

Section 173.417(b)(2) has two subparagraphs and a table. Subparagraph (b)(i) deals with material that has a criticality TI of 0.0. For this material, the mass limits are stated in the subparagraph, and are also reflected in the first line of entries shown in Table 5, which follows subparagraph (b)(ii). Subparagraph (b)(i) also states that the maximum H/X ratio is 3, including all sources of hydrogen within the inner 2R containment. There is no restriction as to U-235 enrichment.

Subparagraph (b)(ii) deals with material with a criticality TI greater than 0.0 and refers to Table 5 for allowable masses. All of the footnotes to the table are important and should be heeded. For material under this subparagraph, when considering the H/X ratios, only the hydrogen interspersed with the fissile material must be considered. There is a 93.5% enrichment restriction for this material. When using Table 5, you may not interpolate values. If the mass you have is in between two values in the table, use the higher value.

DOT Specification 7A Type A

Use of a DOT Specification 7A Type A package is authorized for Type A quantities of fissile material under 173.417(a)(3). Packaging content limits are in 10 CFR 71, Subpart C. Section 71.14 authorizes the use of DOT Specification packaging. Although written for NRC licensees, anyone may use packaging in this Subpart, subject to the stated requirements. DOE contractors can avert their eyes when reading some of the language written expressly for NRC licensees. For example, DOE contractors do not have to have a QA program approved by the NRC, but should be operating under an approved DOE QA program that covers packaging operations.

The mass restrictions for the 7A packaging are stated in sections 71.18 through 71.24. Restrictions are mass/package under 71.18 and 71.20, and mass/shipment under 71.22 and 71.24 (note that the latter two also require that the shipments be offered as fissile material controlled shipments).

To use these sections, simply compare your material with the various sections. 71.18 and 71.20 have provisions for calculating the criticality TI. Sections 71.20 and 71.24 do not have this, as the mass restriction is per shipment rather than per package (i.e. the shipment is complete, and is offered as fissile material controlled). The sections are split between either limiting mass alone, or limiting mass and moderator. Sections with the wording "limited quantity" are restricting mass, and with the wording "limited moderator" have additional restrictions on moderating materials. Sections with the wording "controlled shipment" require the shipment to have the controls found in 49 CFR 173.457. Care should be taken to not confuse the NRC language with the DOT definition of limited quantity or fissile material controlled quantity...the NRC's usage is not consistent with the DOT definition of these terms.

When using the tables in 71.20 and 71.24, do not interpolate for masses in between values, but use the higher value stated in the table. For insight into how the values were determined, see NUREG/CR-5342, "Assessment and Recommendations for Fissile-Material Packaging

Exemptions and General Licenses Within 10 CFR Part 71". This document is available from the NRC homepage at: http://www.nrc.gov/NRC/reference.html . This document will also give you an idea of what NRC is contemplating as far as revising these sections of their regulations.

When using a DOT Specification 7A packaging the shipper is required to maintain on file, for at least one year after shipment, complete documentation of the tests and an engineering evaluation or comparative data showing that the package used met the specification [173.415(a) and DOE O 460.1A, 4.(4)(a)]. DOE has a database with 7A testing and evaluation information available on the internet at the RAMPAC homepage at: http://www.rampac.com .

NRC/DOE Approved Packagings

Packagings that have been certified for fissile contents by either the NRC or DOE will have a Certificate of Compliance (CoC) issued by the respective entity. Authorized contents for the package, as well as any controls, such as an assigned criticality TI will be provided in the CoC. NRC approved packages may be used by DOE contractors if DOE is registered with the NRC as a party to the approval [see 173.471 and DOE O 460.1A 4.(4)(b)]. Shippers must have a current copy of the CoC and comply with all the provisions of the certificate. Shipments can be made if the expiration date has passed but the certificate is under timely renewal.